

What Is Claimed Is:

1. A storage system, comprising:

a first storage unit having a first storage volume for storing data; and

a second storage unit communicably coupled to the first storage unit and having a second storage volume for storing data, wherein

the first storage unit includes a data transmission unit for transmitting replicated data to a storage unit when data is written to the first storage volume;

the second storage unit further includes a data reception unit for receiving the replicated data and writing the replicated data to the second storage volume;

the first storage unit further includes a disk heart beat write unit for repeatedly writing a first heart beat message to the first storage volume at intervals within a predetermined time; and

the second storage unit further includes a disk heart beat detection unit for detecting a replication of the first heart beat message to be written to the second storage volume by the data reception unit.

2. The storage system according to Claim 1, wherein:

- a first information processing unit is communicably coupled to the first storage unit,
- a second information processing unit is communicably coupled to the second storage unit,
- the first information processing unit further comprises a node heart beat write request unit for repeatedly transmitting a request to write a second heart beat message to the first storage volume, to the first storage unit at intervals within a predetermined time,
- the first storage unit further comprises a node heart beat write unit for writing the second heart beat message to the first storage volume according to the write request of the second heart beat message,
- the second storage unit further includes a node heart beat transmission unit for transmitting a replication of the second heart beat message to be written to the second storage volume by the data reception unit to the second information processing unit, and
- the second information processing unit further comprises a node heart beat detection unit for detecting the replication of the second heart beat message to be transmitted by the node heart beat transmission unit.

3. The storage system according to Claim 1, wherein the first storage unit further comprises a disk heart beat creation unit for creating disk heart beat signals to provide the first heart beat message.

4. The storage system according to Claim 2, wherein the first information processing unit further comprises a node heart beat creation unit for creating node heart beat signals to provide the second heart beat message.

5. The storage system according to Claim 2, wherein:
the second storage unit further includes a disk heart beat detection result transmission unit for transmitting a detection result of the replication of the first heart beat message by the disk heart beat detection unit to the second information processing unit, and

the second information processing unit further includes an operation status decision unit for determining operation status of a first computer system, the first computer system including the first information processing unit and the first storage unit, using detection of the first heart beat message and the second heart beat message.

6. The storage system according to Claim 5, wherein the second information processing unit further comprises a fail-over control unit which transfers information processing from the first computer system to a second computer system, the second computer system including the second information processing unit and the second storage unit depending upon operation status of the first computer system.

7. The storage system according to Claim 5, wherein the second information processing unit further comprises an operation status display unit for providing the operation status of the first computer system to a user interface.

8. The storage system according to Claim 1, wherein the first heart beat message includes at least one of: (1) identification information of the first heart beat message, (2) time information indicating when the first heart beat message was created, (3) first location information indicating a storage position of the first storage volume where the first heart beat message is written, and (4) second information indicating the storage position of the second storage volume where the first heart beat message is written.

9. A method for controlling a storage system which system includes a first storage unit having a first storage volume for storing data, and a second storage unit in communication with the first storage unit and having a second storage volume for storing data, wherein the first storage unit includes a data transmission unit for transmitting replicated data to the second storage unit when the data is written to a first storage volume, and the second storage unit includes a data reception unit for receiving the replicated data and writing the replicated data to the second storage volume, the method comprising:

in the first storage unit, repeatedly writing a first heart beat message to the first storage volume at intervals; and

in the second storage unit, detecting the replicated first heart beat message to be written to the storage volume.

10. The method according to Claim 9, in which a first information processing unit communicates with the first storage unit and a second information processing unit communicates with the second storage unit, the method comprising:

repeatedly transmitting from the first information processing unit a request to write a second heart beat message to the first storage volume;

writing the second heart beat message to the first storage volume;

transmitting from the second storage unit to the second information processing unit a replication of the second heart beat message; and

at the second information processing unit, detecting the replication of the second heart beat message.

11. The method according to Claim 9, further comprising creating disk heart beat signals at the first storage unit to provide the first heart beat message.

12. The method according to Claim 10, further comprising creating the node heart beat signals at the first information processing unit to provide the second heart beat message.

13. The method according to Claim 10, further comprising:

from the second storage unit, transmitting a detection result of the first heart beat message to the second information processing unit; and

at the second information processing unit, determining operational status of a first computer system which includes the first information processing unit and the first storage unit using reception of the first heart beat message and the second heart beat message.

14. The method according to Claim 13 further comprising transferring information processing from the first computer system to a second computer system which includes the second information processing unit and the second storage unit according to the operational status of the first computer system.

15. The method according to Claim 13 further comprising at the second information processing unit providing the operational status of the first computer system to a user interface.

16. The method according to Claim 9, wherein the first heart beat message comprises at least one of: (1) identification information of the first heart beat message;

(2) time information indicating when the first heart beat message was created; (3) information indicating a storage position of the first storage volume; and (4) information indicating a storage position of the second storage volume.

17. A storage system comprising: /

a first computer system including a first storage unit having a first storage volume for storing data, and a first information processing unit communicably coupled to the first storage unit; and

a second computer system including a second storage unit having a second storage volume for storing data, and a second information processing unit communicably coupled to the first storage unit;

the first storage unit includes a data transmission unit for transmitting replicated data to the second storage unit when the data is written to the first storage volume,

the second storage unit includes a data reception unit for receiving the replicated data and writing the replicated data to the second storage volume,

the first storage unit includes a disk heart beat creation unit for repeatedly creating a first heart beat message, and a disk heart beat write unit for repeatedly

writing the first heart beat message to the first storage volume at intervals;

the second storage unit further includes a disk heart beat detection unit for detecting the replicated first heart beat message, and a disk heart beat detection result transmission unit for transmitting a signal indicating receipt of the replicated first heart beat message by the disk heart beat detection unit to the second information processing unit;

the first information processing includes a node heart beat creation unit for repeatedly creating a second heart beat message, and a node heart beat write request unit for repeatedly transmitting a request to write the second heart beat message to the first storage volume;

the first storage unit includes a node heart beat write unit for writing the second heart beat message to the first storage volume according to the write request of the second heart beat message;

the second storage unit includes a node heart beat transmission unit for transmitting to the second information processing unit the replication of the second heart beat message written to the second storage volume by the data reception unit;

the second information processing unit includes a node heart beat detection unit for detecting the replication of the second heart beat message, and an operation status unit for determining operational status of the first computer system according to the second heart beat message and the first heart beat message, and a fail-over execution unit for transferring information processing from the first computer system to the second computer system according to the operational status of the first computer system.

18. The storage system according to Claim 17, wherein:
the first heart beat message includes at least one of: (1) identification information of the first heart beat message, (2) time information indicating when the first heart beat message was created, (3) information indicating a storage position of the first storage volume, and (4) information indicating a storage position of the second storage volume; and

the second heart beat message includes at least one of: (1) identification information of the second heart beat message, (2) time information indicating when the second heart beat message was created, (3) information indicating a storage position of the first storage volume,

and (4) information indicating a storage position of the second storage volume.

19. A first storage control unit communicably coupled to a second storage control unit for controlling reading and writing of data to first, second and third storage volumes, including:

- a data transmission unit for transmitting replicated data to the second storage control unit when data is written to the first storage volume;

- a disk heart beat write unit for writing a first heart beat message to the first storage volume;

- a data reception unit for receiving a replicated second heart beat message written to the second storage volume by the second storage control unit, and in response writing the second heart beat message to the third storage volume; and

- a disk heart beat detection unit for detecting the second heart beat message written to the third storage volume.